

Mobile communications at Telefónica in the 20th century

Luis Lada

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1. The Background

The 1970 restructuring of telecommunications in Spain was not only the origin of the development of data transmission, but also of mobile communications. In fact, in addition to promoting the RETD, with the acquisition from the INI of the National Telecommunications Company and the National Radiomaritime Company (later Radioindustria Bilbaína), the powerful Maritime Service Department was created at the end of this year, which would operate all long-distance (OC), medium (OM) and short-distance (VHF) telegraph and telephone services.

The model for land mobile services was immediately replicated with the creation in 1971 of the Department of Mobile Communications, whose first task would be roadside assistance services for Highway Concessionaires and the operation of private radio telephony networks. In 1972 the Mensaphonic Service was launched in Madrid and Barcelona and subsequently a Vehicle Warning System and the VIP system of automatic radiotelephones in the 150 MHz band were experimented with, connected as subscribers to the Gran Vía rotary exchange in Madrid, which were not commercialized because the work focused on adopting a complete system of Automatic Telephony in Vehicles (TAV). This was Motorola's IMT-200, a non-cellular mobile phone system in the 200 MHz band that included heavy terminals "recessed" in the trunk of vehicles, connected to an external antenna and a handset and disk system (soon replaced by a keyboard), located in the rear or front armrest.

The system was installed in Madrid, with the Base Station (EB) of Gran Vía and in Barcelona, with the EB of Sant Pere Martir, but it could not be inaugurated because it was not possible to adapt Motorola's central electronic equipment to Telefónica's billing systems, based on step counters that were photographed to process them. until it was decided to use a flat rate, which was very novel at the time. As a result, the service planned for Telefónica's 50th Anniversary was not inaugurated until January 1976. In fact, at the Great Fiftieth Anniversary Exhibition, "Telefónica, History and Future", which took place in 1974 at the Palacio de Exposiciones in the Plaza de Castilla in Madrid, the HST was one of its stars, along with fibre optics and videotelephones. And rightly so, because despite its limitations, in Europe in the 70s there was no automatic mobile phone service like that of the CTNE.

While the operating systems and coastal stations of the Maritime Service were being restructured and modernized, the Mensaphonic Service continued to be extended to the Costa del Sol, Levante, the Basque Country, etc., and a national plan of multipurpose base stations was conceived for all mobile systems, particularly for Private Radiotelephony Services in closed groups without connection to the public network. In the face of the increase in the installations of taxis, town halls, security, service companies, etc., although in the end it was used for Telefónica's Radiotelephony Service system, used to rationalise its facilities and breakdown services, its main user.

The HST extended its coverage to both sides of the Sierra de Guadarrama through the EB of Alto del León, particularly to attend the receptions of the Palacio de La Granja, and to Girona with the EB of Santa Elena del Montseny.

By the end of 1977, the mensaphonic service had been extended to 12 provinces (46 per cent of the population) and 5,300 provinces. The Roadside Assistance Services covered 628 km of toll roads with 288 pairs of poles, while the HST served 400 subscribers and the Radiotelephony Service was already deployed in 10 provinces.

On the other hand, a complete plan for the restructuring and modernization of the Maritime Service was addressed, with new coastal stations and the centralization of operations, with the National Center for Radiomaritime Communications of Madrid-Diana being the paradigm of this process.

2. From HST to TMA

The fluid relationship with Ericsson, which was successfully supplying the first electronic exchanges (AXE), made it possible to learn about the plans for the implementation of a mobile system in four Nordic countries, the NMT-450, which would be cellular, which would facilitate greater subscriber capacity and traffic, would be easily connected to the billing systems already adapted to AXE exchanges and would have several types of terminals. Some transportable, while allowing roaming between countries.

The CTNE decided to jump on that bandwagon and be a pioneer, along with those 4 countries, in having the new mobile communications system. It was decided to differentiate it with the name of Automatic Mobile Phone (TMA) because it would no longer be dedicated exclusively to vehicles, and the non-adjointing interprovincial tariff (such as Seville-Barcelona) was adopted for mobile-fixed, fixed-mobile and mobile-

mobile calls, for which a numbering field was created, 906, which would identify the new mobile virtual province.

Although the Madrid-Atocha TMA exchange was connected to the network in 1982 with a view to the World Cup, the opening of the service suffered numerous delays due to the doubts generated by the commercialization of the service, particularly that of its terminals, which until then were rented like those of the fixed network. Finally, it was proposed that they should be liberalized, with the user being the one who would have to buy an approved terminal and take charge of its installation, once Telefónica had registered it and programmed the subscriber number.

This required that, for the first time, an Official Certification process for equipment in approved laboratories be established in Spain, which demonstrated its usefulness in future processes of opening product markets. This is how terminals from Ericsson, Nokia and Philips were initially approved, the latter under the name of INDELEC, a joint venture with Telefónica, which provided for its assembly plant the remains of Radioindustria Bilbaína that had previously been dedicated to repairing landline telephones.

But the issue of terminals was not the only cause of the slow take-off of the business. The assimilation of mobile phones to the planning process of fixed telephony, which had to start from the DTCC (Telephone Demand by Centers and Exchanges), made it unprofitable to install a BS outside large cities, so roads and tourist areas were not covered, thus slowing down penetration compared to other countries that began the deployment of cellular networks at the same time or later.

If the Nordic countries roamed between them, unfortunately in Europe each country adopted a different system, which also prevented the free movement of equipment and economies of scale that would lower its costs. France, Germany and Italy defined proprietary systems to prevent the implementation of other systems from abroad, such as those of Ericsson or Motorola. The table below shows the situation in Europe with the first generation (1G) of cellular systems.

| Redes Móviles de Primera Generación en Europa | | |
|---|-----------------|---------------------|
| País | Sistema | Inicio de Operación |
| Austria | NMT - 450 | 1984 |
| | TTACS - 900 | 1990 |
| Bélgica | NMT - 450 | 1987 |
| Dinamarca | NMT - 450 | 1982 |
| | NMT - 900 | 1986 |
| Finlandia | NMT - 450 | 1982 |
| | NMT - 900 | 1986 |
| Francia | Radiocom - 2000 | 1985 |
| Alemania | C450 | 1985 |
| Irlanda | TACS - 900 | 1985 |
| Italia | RMTS | 1985 |
| | TACS - 900 | 1990 |
| Holanda | NMT - 450 | 1985 |
| | NMT - 900 | 1989 |
| Portugal | C450 | 1989 |
| España | * IMT - 200 | 1976 |
| | NMT - 450 | 1982 |
| | TACS - 900 | 1990 |
| Suecia | NMT - 450 | 1981 |
| | NMT - 900 | 1986 |
| Suiza | NMT - 900 | 1985 |
| Reino Unido | TACS - 900 | 1985 |

(*) No celular

This caused the concern of the core of the Common Market and at a Franco-German summit the creation of a common standard was promoted, which began in 1982 with the creation of the Special Mobile Group (GSM) of the CEPT, which the CTNE would support, especially when in 1985 the European Commission decided that the standard to be drawn up by the GSM Group would be adopted in all the countries of the EEC. Following the adoption in 1987 of the basic GSM standard and a directive reserving the frequencies to be used, an agreement (MOU) was signed between thirteen countries (the 12 of the EEC and Austria) and their 14 operators (one per country and the two of the United Kingdom), in which they committed themselves to using GSM in their new networks with a preliminary agreement to start operation in 1991. At Telefónica, the signing of this agreement was decided by the Board of Directors, which determined that its signatories would be Javier Domínguez, head of Radio in Technology and Technical Regulations, and Luis Lada, as Deputy Director General of Technology, Planning and International.

Since the initial political impetus was mainly industrial, a development procedure was determined in Brussels based on the creation of several consortia of manufacturers, including those from at least two countries, to supply prototypes for the validation of the system. Everyone who knew and wanted to know about the subject was there, and Telefónica agreed to test two of them, led by Ericsson and Motorola.

In the development of the standard, it became clear that essential patents came from countries outside the common market, which had to be immediately associated with the process in exchange for the assignment of them, so that the other large European manufacturers also demanded to participate, adding to the standard non-essential facilities based on their own patents. to participate in the total distribution of royalties. Meanwhile, in Spain, the Automatic Paging Service was launched in 1987, which should end up replacing the Mensaphonic Service in operation, although it continued to grow and include new versions, such as the simple warning version.

On the other hand, it is considered that the NMT-450 network of the TMA would not have the capacity for the expected demand and, as in other countries, it is proposed to temporarily deploy a new infrastructure in the 900 MHz band until GSM is a reality. A simplistic analysis would suggest that, as the Nordic countries did in 1986, Telefonica would also adopt the NMT-900 standard, but the issue sparked a huge debate in view of the results of mobile telephony in the United Kingdom with the TACS-900 (a version of the American AMPS system) which were generally attributed to two competing operators. but also to other coexisting circumstances.

Costs were one of them, as Ericsson always believed it would have no competition. The quality of the calls was another element that motivated the recording of numerous conversations in London and Stockholm to verify that, since the TACS did not have in-band signaling, the typical periodic clicks in the NMT were not visible. But the decisive issue was the launch of personal mobile phones (Motorola's Micro-CT) which for the user meant a different concept of service, as they could carry the phone in their pocket. That was really the trigger for the success, and the reason why Austria and Italy, as well as the United Kingdom and Ireland, also adopted the system. The promotion of "Il Telefonino" in Italy was the paradigm of its notoriety.

Telefónica recalled the bad experience with Motorola in the support and billing of the TAV, so a joint-venture with Amper (Telcel) was promoted to land in our country. On the other hand, the lower 900 MHz band was used, thanks to the band extension already adopted by TACS (ETACS), to use less of the GSM band. By the end of 1989 the TMA-900 was ready for operation, although it was commercialized in the early 1990s.

3. The pan-European system

The European Commission began to promote a series of standards that would allow for a common market for common goods and services: DECT for cordless telephones, ERMES for digital radio messaging, Telepoint, TETRA for private radiotelephony, etc., which would later be partly absorbed by the success and new features of GSM. But at the same time, competition between operators was promoted, determining that the implementation of the new digital services would be done in competition, distributing among the licensed operators the common band to be used.

It is agreed that GSM was the second generation (2G) of mobile telephony and so it was in the United Kingdom, where they began to compete with the TACS 900 in 1985 before moving on to GSM. But in Spain there were three others before: the TAV (IMT-200), a non-cellular mobile system with embedded telephones, the TMA-450 (NMT-450), a cellular mobile system with portable telephones, and the TMA-900 (ETACS-900), a cellular mobile system with portable and personal telephones. But all of them are analog.

Under the inspiration of the first Community Directives on the liberalization of telecommunications services, the enactment of the Telecommunications Regulation Law (LOC) and the subsequent new Telephone Contract with the State of 1987, already included the capacity of the Administration to introduce competition in the provision of Services. For this reason, Telefónica was adapting its procedures for building the network and marketing services for the new stage that was coming.

By 1990, the TMA had 54,700 subscribers and was growing rapidly at the same time as the implementation of GSM for the Olympic Games was planned. OO in Barcelona and the Expo in Seville in 1992, although, in the end, due to the lack of digital terminals, everything was supported by the TMA, which ended the Olympic year with 180,000 customers.

But 1992 was also the year in which, in the face of pressure to extend the urban telephone service to the entire population, the TRAC (Rural Cellular Access Telephony) system was defined with special fixed ARCE (Cellular Radio Adapter) equipment, equipped with an electrical power supply, battery, radio module and antenna, with access to the ETACS-900 network and which had a rosette for the connection of an internal telephone network Fixed.

To meet part of the Telephone Service Extension Plan, a special category of subscribers was generated in the mobile network and the installation of a considerable number of new base stations in remote places was planned, particularly in Galicia, which were financed by the Autonomous Communities in Agreements that determined the populations to be served and the priority of the areas to be covered. The limitations of the system for certain applications soon became apparent, requiring it to be brought up to date with the facilities of secraphony, authentication and data transmission, in what was called TRAC Advanced.

By 1993 the TMA covered 92% of the population and more than 85% of the territory, including maritime coverage that made it popular on inshore fishing vessels and pleasure craft, and was provided with detailed billing reaching almost 260,000 customers. At the same time, and as a foretaste of what was expected for mobile telephony, three national radio messaging licenses are being tendered, one of which is awarded to Telefónica, which transforms its mensaphonic service into MensaTel, with almost 50,000 subscribers this year and which would be operated by a subsidiary company of Telefónica, TS1, later Telefónica Servicios Móviles. It was set up to offer some competing services, and in 1994 it began to market, on behalf of Telefónica, the Mobile Telephony Service, which is called MoviLine.

This was the beginning of the creation of a large network of commercial distributors, TV advertisements, etc., which in 1994 increased the number of mobile telephone customers to 412,000, in a network that also supported 146,000 TRAC connections and that made it possible to increase mobile coverage to remote areas to facilitate the provision by others of all kinds of services to the citizen. Another driver of the growth of mobile customers was the decision to reduce the connection fee to a third, which was traditionally double that of the domestic telephone service despite the fact that it was the customer who paid the costs of its "subscriber loop", which is the mobile terminal. It was advertised with a resounding "baja el alta", to give notoriety to the song.

Faced with the evidence that the connection and subscription fees did not make sense in mobile telephony and that with the freedom of tariffs in the GSM they would disappear, a new reduction of the connection fee was requested from the Administration, which was rejected so that the MoviLine Service would not grow further and a greater market would be provided to the second operator. that he would then pay a higher amount for his license. The consequence was that, since the terminal was liberalized, the amount of the

connection fee was transferred to the distributor so that it could be passed on to the customer by reducing the price of the terminal, thus initiating the subsidy to the terminals and the explosion of demand for a service that now had very low barriers to entry.

Private radiotelephony, already in competition, follows the same path as MensaTel, creating RadioRed as a subsidiary of Telefónica Móviles, at the same time as the adventure of Unisource Mobile begins for the participation in licenses in other European countries, which did not bear fruit for the same reasons that made Telefónica not attend the auctions of the second mobile licenses in Latin America.

In 1994, the second Mobile Telephony license was also put out to tender in Spain, when several European countries already had it theoretically in operation, but with a dramatic lack of terminals that generated the joke of a German executive when he exclaimed: God Send Mobiles! (GSM). The reason was none other than that the manufacture of the portable terminals depended on the supply of the "chip-set", in the hands of North American and Asian suppliers who did not have GSM as their priority, while the network equipment was manufactured without problems.

4. The explosion of mobile service

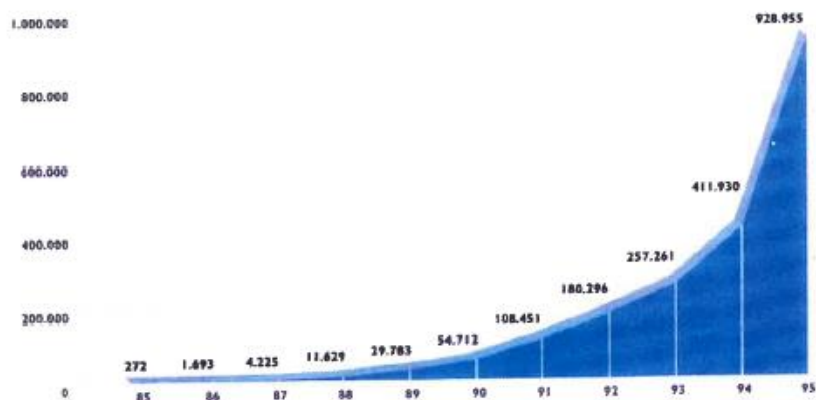
Telefónica's 1995 Report defines this year as that of Mobile Telephony, not only because the growth in the number of customers was the highest in Europe, reaching 892,000 for MoviLine, but also because the GSM service was finally launched, even if it was not peacefully.

Telefónica transferred to its subsidiary Telefónica Servicios Móviles all its assets (valued at 127,000 million pesetas) and liabilities of 68,000 million pesetas, so that it could exhibit transparent and audited accounts, comparable to those of its future competitor and prepare it for a potential corporate operation, if deemed appropriate. But, although it was ready to start GSM service at the beginning of the year, complying with all coverage and regulatory obligations, the Administration blocked its opening to wait for the second operator.

The wedding of H.R.H. the Infanta Doña Elena in Seville in March 1995 was the reason why a special authorization was obtained to temporarily open the network, so that guests from other countries could use their mobile phones, but it had to be closed again until pressure from different ministries to allow it to be used in sectoral meetings of ministers

of the European Union, organised under the Spanish Presidency, led to the granting of final authorisation on 25 July 1995. The network was immediately opened to visitors, but, given the date, the commercial launch did not take place until the beginning of September of that year, with a large convention of distributors. There it was announced that the name of the service would be MoviStar, with a strong advertising campaign ("A star is born") and a new system of remuneration to distributors in the face of the lucrative offers they had to become exclusive to the competition. This is how the brand that would end up being common to all Telefónica products in our country was born in Spain.

EVOLUCIÓN DE CLIENTES DE TELEFONÍA MÓVIL EN LA ÚLTIMA DÉCADA



In October 1995, the second operator began operations and the year ended with almost 37,000 MoviStar customers, with the GSM network covering 58% of the territory and 78% of the population (90% territory, 98% of the population a MoviLine), with roaming agreements with 31 countries and 46 operators. There were already features such as Voicemail, both in MoviStar and MoviLine and the Mobile Office Service for data. For its part, RadioRed obtains one of the Digital Radiotelephony licenses for closed groups of users with the pan-European TETRA standard.

In addition to the facilities already introduced by MoviLine: the telephone number belonged to each person (not collective), who was called wherever they were (not in a specific place), it was dialed by pressing a key confirming the number that appeared on the screen and a powerful Customer Service was offered to which you could ask about everything; GSM mobile telephony introduced the novelty of the SIM card, where there were the customer's data that personalized the terminal and that could be changed whenever he wanted, the identification of the number he called, roaming in other countries, which extended coverage beyond borders, the encryption of communications

to avoid unwanted eavesdropping and soon a novelty not foreseen in the rules, the ability to send and receive alphanumeric texts, SMS. Initially, this facility was defined only for the communication of the operator with the user. But it was such a success among users, despite the fact that the terminals only had numeric keypads, that it was necessary to install powerful messaging systems and start pricing messages, since it soon spread that they were free and there were practices of mass sending from computers for advertising purposes.

Another novelty was the launch in 1996 of the prepaid SIM card, under the name of MoviStar Activa, being the second European operator to introduce it and which soon became rechargeable at any distributor and then at ATMs and POS terminals of Large Supermarkets. The control of expenditure and the fact that it is anonymous for the operator were the foundations of its commercial success. Likewise, the MoviStar Corporate service for companies was introduced, which aimed to replicate the successful Ibercom model of fixed telephony.

For the network, the changes were generated due to the explosion of growth, the highest in Europe in 1996, which ended with 2.35 million users in Spain, of which 1.3 million were MoviLine (in addition to 220,000 TRAC). In fact, the pace of network construction required the installation and connection of 8 new EBs per day, modifying the coverage of those in its surroundings and expanding dozens per week, as well as connecting 2 plants per month, which made it necessary to increase the workforce and to equip itself with a powerful Operation and Maintenance Centre. precursor of the one that later settled in Aravaca.

The need to install numerous base stations forced a rethinking of the construction model followed to date, which was identical to that of the Radio Relay Stations, with practicable brick huts, with a large lattice tower and security fence on a relatively large plot, together with the preferential use, in urban areas, of Telefónica's exchange buildings. although they were not the most suitable points due to their height or location, and where the equipment was installed in the transmission room, generally on the ground floor near the cables, but very far from the antennas. For this reason, the system for searching for sites and contracts with owners and the use of containers with pre-installation of the equipment was strengthened, for a faster and more effective expansion of coverage and capacity, as well as for the improvement of quality.

In short, a new industry was generated with tens of thousands of commercial, logistics, installer and auxiliary industry jobs that was also used by the competitor to achieve a faster deployment than planned.

The extension of mobile phone coverage was possible thanks to an enthusiastic group of hiking and mountaineering technicians who, not only got to know all the corners of our geography, but before digital cartographies or radio planning tools were handled, they were great users of IGN maps. On the other hand, they had complete knowledge of all the festivals, fairs and sporting events or concerts that attracted crowds to deploy their mobile units to reinforce the capacity of the network: from San Fermín to the Fallas, from the Aste Nagusia to the Descent of the Sella, the Feria de Abril or El Rocío, the Carnivals, Easter or Moors and Christians, F1 or GP Races, Penguins, etc., all ended up being part of a well-planned annual programme of activities. On the other hand, these mobile units proved indispensable in the event of fires and flooding of telephone exchanges.

The calls of the clients to the CAC or the enthusiastic collaboration of all the staff in their private trips to identify points with poor coverage or where communications were dropped, in addition to the hundreds of thousands of kilometers traveled by the optimization teams, generated a database that, together with the commercial priorities, triggered the process of creating new EBs or optimizing existing ones. With the arrival of competition, there is a fight to get the best sites or the common use of existing ones. If it was easy to share roads or power lines, the joint use of the masts was always problematic because everyone aspired to place the antennas on the same stretch.

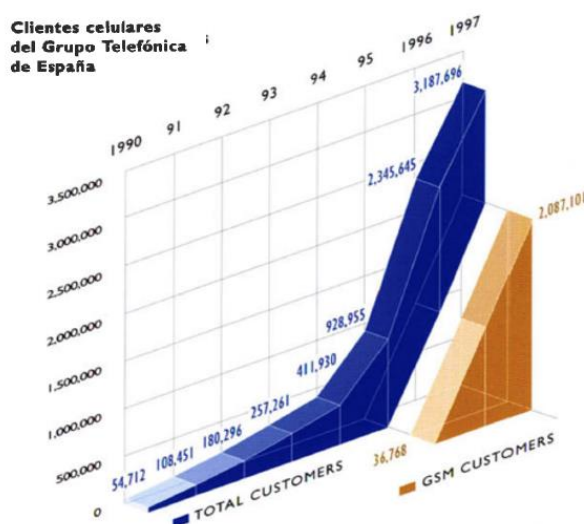
Another oft-repeated adventure was the interference of the mobile signal with that of the TV repeaters that did not have filters for their band and amplified any signal they received, which was not easy to explain to the citizens because until our arrival there were no problems.

More serious were the movements that blamed the development of cancer in some residents on the signals of the EB (not the mobile phones). When it was really a question of covering up aesthetic problems, the camouflage of the antennas could be the solution, but there were pseudoscientific charlatans who generated a certain state of alarm that the Administration wanted to face with Royal Decrees, explaining that, although the relationship of non-ionizing electromagnetic radiation with health had not been demonstrated (yet?), reasons of prudence advised, etc., etc. Obviously, magical thinking

is not combated with the BOE and a great communication plan had to be deployed with serious professionals to try to placate the movement, which experienced really regrettable cases. Those who tried to link the COVID19 pandemic to the 5G trials were worthy successors to those enlightened.

On the other hand, the core of the mobile network was also changing, since the initial combination of Base Stations (BS), Base Station Controllers (BSC) and Switchboards (MSC) was joined by the Gateways for connection with other networks, the Customer Registries (HLR) and Visitor Records (VLR) and numerous Service Centers (messaging, etc.), Operation and Maintenance. etc., which turned some nodes of the network into a kind of Data Center.

The frenetic development lasted several years and so in 1997, with more than 3 million users, a cumulative investment of 464,000 million pesetas was reported, more than 3,000 million calls were made with more than 5,000 sites in service. The ISO 9001 quality certification issued by AENOR was obtained and the coverage of the AVE, Cercanías, Suburban, etc., and the interior of the tall buildings was ensured, by means of microcells that cancelled out co-channel interference, as a signal was received from multiple base stations. MensaTel is also trying to join the wave of the consumer market generated by mobile telephony, launching its Beeper product.



The resounding success of GSM technology and many operators, which made it possible to realize large capital gains to their original shareholders, motivated governments to

make new concessions in the 1800 MHz band. The first was the United Kingdom, which wanted to launch 4 licenses for operators other than GSM and with the aim of developing a more advanced technology that they called DCS (Digital Communication System). In the end, economies of scale forced the use of the GSM standard, which by then already included many improvements, and only two additional operators ended up launching the service.

In general, the model of tendering at least one licence in addition to the existing licences was adopted, allowing incumbent operators to participate in the process, as the 900 MHz band assigned to them was already insufficient for them. This was the case in Spain, where the two operators obtained a GSM 1800 license (but not before paying 29,000 million pesetas) and a third license was tendered.

When the threshold of 5 million customers was reached, in 1998 the maritime coverage of the Peninsula-Balearic corridor and between all the islands, Mediterranean and Canary Islands, was addressed to provide service to ferries. Numerous services for companies and internet access are launched, while the young market is sought with multiple offers, prepaid and contracted, in packs with low-cost phones. Digital TRAC terminals connected to the GSM 900 network are also being installed.

The GSM standard evolved to improve voice quality withEFR (Full Rate Link), and data transmission capacity with GPRS (General Packet Radio Service) or EDGE (Enhanced Data rates for GSM Evolution), which ended up being colloquially called 2.5G and 2.75G, while waiting for what was supposed to be a definitive solution for mobile data transmission: 3G.

In 1999 Telefónica already had almost 9 million customers in Spain (and 10 million in Latin America) and mobile phones were already dual-band, which made it easier to switch on GSM 1800 EBs. As Movistar gained in coverage and services, MoviLine decreased the number of customers. Thus, in 1999 it had 690,000 customers while GSM exceeded 8,300,000, although it was not until the end of 2003 that new connections to the analogue network were no longer admitted, which was basically left to the TRAC, and the network was definitively shut down at the end of 2008, although in the process multiple retunings of the EBs had to be carried out. which at that time was not easy, in order to adapt to the successive reductions in the band allocated to cede frequencies to GSM.

Before the launch of the third operator, an agreement was reached with it, and subsequently with the second, that would allow a rapid start of its operations based on a national roaming agreement on the two existing networks (the North and Balearic Islands for one and the South and Canary Islands for the other), with an initial minimum coverage and a scheduled progressive disconnection. which would be complete in two years. In this way, it would be forced into an even greater investment than initially planned and would be motivated to have a commercial attitude that would not destroy the market, as would happen in the case of not having a competitive coverage at its launch.

The great international diffusion of GSM is evidenced by the fact that, in that year, MoviStar had roaming agreements with 181 operators in 93 countries, which contrasted with the total dominance of the United States a decade earlier. That fact was always considered the greatest success of the European Union's technological/industrial policy.

While GSM was being developed in Europe and other countries, in the United States an absurd model of operators limited to metropolitan areas and with different standards was maintained, calls received without identifying the caller were made to pay to the mobile phone, multiple new local licenses were granted to groups with no interest in the business, and a quasi-religious war was maintained among the supporters of TDMA technology. led by Ericsson and CDMA technology with Qualcomm and Motorola at the forefront, in which it seemed that TDMA was better suited for voice, but CDMA would have more of a future for data. But from today's perspective, it shows how quickly leadership can be lost or gained, seeing the strength of the American market with 3 large national operators and an absolute dominance of the most valuable elements of the mobile communications chain (operating systems, applications and terminals) compared to the European situation with multiple regulators. Almost a hundred operators and only a certain strength in the equipment of the network.

For its part, the ITU wanted to promote a universal standard for mobile communications, IMT-2000, of which the UMTS (Universal Mobile Telecommunications System) was one of its selected systems and which, with the perspective of the future of data and to attract the United States, was able to promote a universal standard for mobile communications. In the U.S., it was based on CDMA, which was patented by Qualcomm, the company that manufactured the chip-sets for the terminals of that access technology.

If there was no patent assignment agreement, CDMA could not be used in UMTS, which delayed negotiations until Ericsson and Qualcomm reached an agreement whereby Ericsson agreed to buy all of Qualcomm's network equipment factories, went on to market 2G CDMA and accepted a very high royalty for the use of the patent. immediately cease the bellicose declarations about technologies. On this basis, many manufacturers would return to the process followed for GSM of including in the UMTS standard facilities of very remote potential use based on their own patents to participate in the distribution of royalties that were supposed to be very greedy, given the market that GSM already had, but which raised the total bill for this concept in UMTS terminals to scandalous levels. It was said at the time that citizens should not only be unaware of how sausages were made or the laws, but also international standards.

Meanwhile, Movistar's evolution in the data market continued its process, launching Movistar Internet, which would allow mail on the mobile phone and the WAP (Wireless Application Protocol) microbrowser in collaboration with Terra Networks, which was followed by the WISP (Wireless Internet Service Provider) called e-motion, which was advertised as "internet in the palm of your hand".

For this world, and to avoid conflicts, a joint venture with Terra Networks called Terra Mobile was formed, which ended up being acquired by the Finnish listed company IObox at the height of the punto.com bubble. Nothing remains of that, except the interest in being pioneers among mobile operators to incorporate new services and applications.

Another example was the incorporation of the Mobipay Company to make micropayments with mobile phones at a much lower cost than credit card processors. The obligation imposed by the Competition Commission to incorporate all banks, savings banks, and operators, ended up generating an assembly model that aborted its development, as many intended from the beginning. Now, with new solutions and technologies, that attempt is still seen as something too premature to extend and make more efficient Spain's powerful payment model.

The Spanish government launched a tender for 4 UMTS (3G) licenses that were awarded in 2000. The business plan, the planned deployment and other social issues were assessed, with the documentation presented by Telefónica Móviles occupying 10 large and heavy boxes. The tender was decided with Telefónica obtaining the highest score, making it clear that if the GSM license was originally held, not only by the Contract with

the State, but as part of the MOU that gave birth to the GSM, like all the other signatories, when it had to compete it knew how to do it successfully, in the tenders, in the deployment of networks and in the marketing of services, as evidenced by the high market share of Movistar, MensaTel and RadioRed.

But neither the network technology nor the terminals were ready on that date. UMTS was not universal and CDMA was not the most suitable access technology for data communication, as OFDMA demonstrated in the brilliant 4G standard. But that 3G was our 3G, with which we would have to compete, knowing that, as happened with 2G, there would later be many improvements in the network, in the terminals and in the applications, which would overcome the limitations of the initial standard, its royalties and the way in which it was conceived. By the way, that made some see that the even-numbered generations (2G, 4G) were much brighter than the odd-numbered ones (1G, 3G).

Let's hope that with 5G this assumption will be forgotten, since, contrary to what happened with previous generations, it has not been wanted to differentiate by changing the access technology, but with a network core concept adapted to new applications. Although it does seem that the rule is maintained that every 10 years a new generation must be ready, whether or not it is necessary, which usually also takes 10 years between its conceptual definition and the first terminals in operation, so that three operational generations coexist, the one that is launched, the one that is in full growth and the one that is already in its decline. However, the existence of multi-standard terminals makes management very different from how the coexistence of NMT, ETACS and GSM was experienced.

The great evolution of terminals from the first GSM terminals with a slot to incorporate the large card with the SIM chip, to the multi-band, multi-standard, with a large color screen and camera, features of all kinds, has been one of the determining elements of the success of mobile telephony. We still remember the babbling of multimedia messaging (MMS) with the first non-standardized emoticons, which could only be reproduced by terminals from the same manufacturer, or the explosion of mobile mail, particularly with Blackberry terminals, which had a QWERTY keyboard and required their own server, which Telefónica soon installed, as significant examples. In fact, Telefónica was the first European operator to launch GPRS in January 2001 in order to channel the large increase in data traffic generated by this device through a packet network and

provide the ease of a permanent (always-on) connection. All of which was forgotten with the advent of smartphones, especially since the launch of Apple's iPhone in 2008 and its app store.

Due to their great potential downstream, it is worth noting the addition of two other forms of access to the terminals. First of all, Bluetooth, which became widespread to facilitate mobile access to hands-free functionality but has been extended to many other applications. Or WiFi, which initially seemed to be a hotel service so that customers would not have to pay high data roaming bills, and which has later become essential in all homes and establishments to channel the huge amount of data exchanged through the networks, although, yes, it promoted flat rates for data as it happened in fixed networks. In short, it became clear that there was and will be data for everyone.

A final consideration on the limitations to deal with markets whose customers are largely Public Administrations, was the effort made to channel through the TETRA license of RadioRed the initiatives of multiple organizations that wanted to have a radiotelephone service in a closed group. In addition to the common desire to have their own network and even to use it to provide services to third parties, there was a lack of coordination between them, which was evident in the large forest fires. But perhaps the most significant was the competition of the Ministry of the Interior, which not only proposed to have its own network, using the locations of the mobile network and the maintenance of its equipment by Telefónica, but also set the Tetrapol standard instead of the TETRA, which determined that the provider would be the one of this proprietary system.

Although only to link to the beginning of this chapter, it should be noted that the Maritime Service reduced its activity with the transfer to SASEMAR of all services without public correspondence, although the operation of the coastal stations remained subcontracted for some time, until Telefónica was replaced by Abertis Telecom (Cellnex). On the other hand, the growing penetration of Inmarsat caused the decline of CO traffic, so in May 2009, 38 years after its creation, the Maritime Service was eliminated with the closure of Madrid-Diana and the closure of the radio stations of Pozuelo and Griñón, as had already happened 10 years earlier with the radiotelegraph station of Aranjuez.

We cannot forget the fact that Telefónica decided in 2000 to group all its mobile operations around the world in Telefónica Móviles (20 million customers at that time) and carry out an IPO (capital increase) on the Spanish MC and NYSE stock exchanges. After

that operation, it became one of the largest companies on the Ibex by capitalization, although the experience would not last long. Listed shares would soon be bought back and eventually fixed and mobile assets would be grouped by country, all of which may have been a distraction from technical and commercial objectives, but forced deep external scrutiny of management.

As Telefónica celebrates its centenary, its mobile communications can be considered to be celebrating the first 50 years of a stimulating development, the first half of which we have recalled in this chapter, but which will accelerate its prominence in the next one, dedicated to mobile broadband. If the last third of the 20th century described cellular telephony, the internet, the great transformative waves of telecommunications of the last century, their convergence, together with AI, is causing the Great Wave of economic and social transformation that we have the privilege of living in this first quarter of the 21st century, which is going to be much more transcendent. although less plastic, than Kanagawa's.



The Great Wave of Kanagawa - Katsushika Hokusai. MoMA



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